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AUTHOR Doyle, Andrea; And Others
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ABSTRACT

To aid secondary science instructors and supervisors in selecting texts that provide adequate coverage of population dynamics and impacts, 44 editions of life science, biology, advanced placement biology, and environmental science textbooks were surveyed. The matrices given in this document are designed to provide objective information on each text's inclusion of specific topics related to population and human ecology. This format shows trends in the texts, allows individual texts to be compared, and serves as a tool for educators interested in supplementing weak areas of their specific text. A list of basic information that should be included in a reasonably thorough discussion of human ecology forms the basis of each matrix. These topics fit into categories of general population information, human population dynamics, projections about the future, and the link between population growth, resource depletion, and the environment. Each matrix lists (1) publisher, title, publication date and author; (2) the presence of material on nonhuman population dynamics, human population dynamics, population and the environment, and population and the future; and (3) placement of this material in the text and length (number of pages). The presence of thought-provoking student activities, discussion questions, and supplementary materials such as maps, graphs, and photographs were also considered in assessing textbook effectiveness. (KR)

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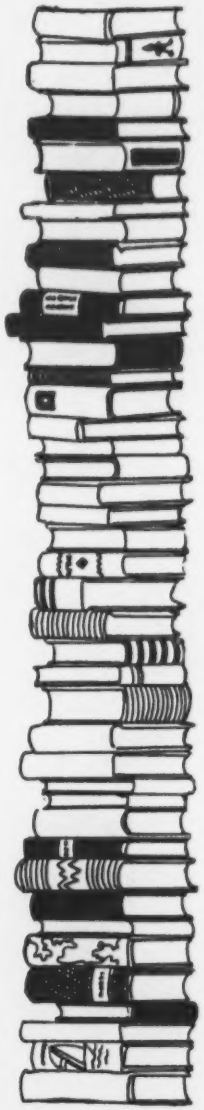

Teaching Population: Which Textbook to Choose ?

A Survey of Secondary Science Textbooks

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By Andrea Doyle, Benjamin Mintz, and Pamela Wasserman
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Preface

Today's junior high and high school students inhabit a rapidly changing world which they share with 5.3 billion people. Within their lifetimes, they will likely have to share limited natural resources with more than 10 billion others and struggle to restore a deteriorating environment.

Our population, now expanding by 93 million people each year, has a profound impact on the biosphere: air and water pollution, ozone layer depletion, deforestation, waste disposal problems and species extinctions all have roots in population growth.

Given the impact of humans on the environment, population issues should be included in any class discussion on the earth's fragile ecosystems. Sadly, many life science and biology textbooks either touch briefly on human population topics in the last chapter or omit the subject matter entirely. Although supplemental materials for population education are available, most secondary teachers still rely on their textbooks as primary classroom resources.

To aid secondary science instructors and supervisors in selecting texts that provide adequate coverage of population dynamics and impacts, ZPG's Population Education Program has surveyed 44 current editions of life science, biology, advanced placement biology, and environmental science textbooks. The matrices below are designed to provide objective information on each text's inclusion of specific topics related to population and human ecology. This format shows trends in the texts, allows individual texts to be compared, and serves as a tool for educators interested in supplementing weak areas of their specific text.

A list of basic information which should be included in a reasonably thorough discussion of human ecology forms the basis of each matrix. These topics fit into categories of general population information, human population dynamics, projections about the future, and the link between population growth, resource depletion, and the environment. In addition, categories of length and placement are included.

The matrix should not be the only tool used when assessing the effectiveness of a book's coverage of population. Other qualitative features also play important roles in evaluation. Some books barely touch on several topics, giving them high marks on the matrix, but not elaborating and bringing the issues together in a meaningful way. Others may miss some categories but drive home the importance of studying population ecology.

In addition, the presence of thought-provoking student activities, discussion questions, and supplementary materials such as maps, graphs and photographs can all enhance the text. The texts highlighted in this survey have been strong on these more qualitative topics as well as covering points listed on the matrix.

How the Texts Stack Up

The majority of mainstream texts lack thorough, if any, discussion of population growth and the ecosystem. Most mention a few basics of human population growth. Several link population growth to environmental problems such as depletion of resources, food shortages, or increased pollution, although most do not elaborate on this connection. Very few texts suggest containing growth as a means to alleviate these environmental strains.

Generally, life science texts tend to ignore population topics altogether, biology texts vary more in their coverage, advanced placement texts are thorough but often dry, and specialized environmental science texts provide the best overall coverage of human ecology principles.

Clark Adams and Janice Greene note in their article "Perestroika in High School Biology Education"[1] that most high school biology texts are a watered down version of the molecular biology offered in college. Adams and Clark suggest that, given the intellectual development of most high school students, a more appropriate approach would be to focus instead on more concrete concepts, such as how their lives impact the world in which they live.

The texts reviewed in this survey confirm that secondary life science and biology texts concentrate on a molecular rather than ecological approach. Usually found at the end of the book, the ecology section often appears to be tacked on as an afterthought. About two or three chapters (out of a possible 50 or more) are expected to cover communities and biomes, balance of ecosystems, population dynamics, and the various environmental effects of human behavior. Needless to say, crucial points are often glossed over or omitted entirely.

[1] Pg. 408 *The American Biology Teacher* Vol. 52,#7 Oct. 1990

The Key

The following categories are topics which should be covered in any reasonable discussion of human ecology. The labels below correspond with the letters on the following matrices. Each letter included on the matrices denotes the presence of that topic in the text; the absence of a letter denotes the absence of the topic.

NON-HUMAN POPULATION DYNAMICS
A. Growth rates
B. Fertility/mortality rates
C. Population growth checks
D. Biological/psychological impacts of crowding
E. Other population information

HUMAN POPULATION DYNAMICS
A. Growth rates (cultural comparisons, historical trends, current trends)
B. Fertility/mortality rates (cultural comparisons, historical trends)
C. Migration and distribution patterns
D. Age and sex structures
E. Family size trends
F. Reproductive processes
G. Contraception
H. Recent rapid population growth
I. Demographic transition

INTERRELATIONSHIP OF POPULATION GROWTH AND THE ENVIRONMENT
A. Ecological balances (air, water, and soil pollution; climate change; effects on other species)
B. Land use (urbanization, suburban sprawl, waste disposal, deforestation, desertification)
C. Food/agriculture (world hunger, food distribution, agricultural development)
D. Renewable and non-renewable resources (global and U.S. consumption patterns)

POPULATION AND THE FUTURE
A. Projections and predictions
B. Planning for population change
C. Carrying capacity
D. Potential of technology (advances in family planning methods, increased carrying capacity)
E. Programs to limit population growth

LENGTH
0= No information
1= Less than one page
2= 1-3 pages
3= More than 3 pages, less than one chapter
4= Chapter
5= Unit

PLACEMENT
1/3= First third of book
2/3= Middle third of book
3/3= Last third of book

Life Science

No life science text stood out as exceptional. As the matrix indicates, most books touch on fewer than three of the most basic points about human population dynamics. Several texts do link population growth and environmental problems, but few suggest possible solutions to the dual problem. It is understandable that life science books, designed for middle and junior high school, are not able to cover topics as thoroughly as the longer, more complex biology books for high school students. But that does not merit omitting something as vital as human ecology. Population concepts can be simplified as easily as those of meiosis and DNA -- topics covered thoroughly in most life science books.

Publisher	Title	Year	Author	Non-human Population Dynamics	Human Population Dynamics	Population and the Environment	Population and the Future	Placement	Length
Addison Wesley	*Life Science*	1989	Barr	A B C E	F	A B C D		3/3	3
DC Heath	*Life Science*	1991	Bierer	C D E	A F H	A B D	A	3/3	2
Glencoe/ McGraw-Hill	*Experiences in Life Science*	1985	Magnoli	A B C E	A F H	A B C D	D	2/3	2
Harcourt/Brace/ Jovanovich	*Life Science*	1989	Watkins	A B C E	A B F H		A C	3/3	3
Holt/Rinehart/ Winston	*Holt Life Science*	1986	Ramsey	A B C E	A F H	A B D		3/3	2
MacMillan	*Life Science*	1989	Jantzen		F	C D	A C	3/3	0
Merrill	*Focus on Life Science*	1989	Helmler	C E	A B E F H I	A B C D	A B C	3/3	3
Prentice Hall	*Life Science*	1991	Johnson	C	F			3/3	0
Silver/Burdett/ Ginn	*Life Science*	1987	Alexander	A B C	B F			3/3	2

Biology

The 18 biology texts in this survey demonstrate a wide range of population ecology coverage. Many texts compare to life science in their lack of information about human ecology. However, the situation is not entirely gloomy. Several texts use innovative ways to highlight the importance of population issues. The following examples illustrate the successful incorporation of human ecology into mainstream biology texts.

The Big Winner

One text clearly stood out as superior: *BSCS Green- Biology: An Ecological Approach* by Milani et. al. (Kendall Hunt, 1987). In addition to covering all of the basic information about population growth, *BSCS Green* does an excellent job of introducing the issue in a variety of contexts. Unlike most biology texts, the *Green* version begins with the biosphere, works inward and comes back to the big picture to show interrelationships in nature. Population is not treated as a separate entity, but is considered an integral part of studying ecology and biology.

Chapter 2 includes a general discussion of populations, the history of human population growth, and the link between growth and environmental problems, such as resource depletion. The authors introduce carrying capacity with respect to world hunger. Activities in this section include plotting a graph of a duckweed population, charting population growth of the students' state, and researching the causes of unequal food distribution.

The concept of carrying capacity reappears in the chapter on selection and survival. Later the text looks at changes in various populations due to environmental factors, and compares the birth and death rates of developed and developing countries. The chapter on human-shaped ecosystems refers to overpopulation in terms of urban problems (with a world map depicting percentages of city dwellers), suburbanization, the spread of diseases and pollution, water quality and the general quality of life.

The human reproduction section links overpopulation and the need to limit family size. The text includes discussion of the teen pregnancy problem, the reality of contraceptive failure, and the current controversy surrounding abortion in the United States.

Finally, one of the last sections in the book is entitled, "All Environmental Issues are Connected to Population Growth." Clearly portraying the importance of human ecology in the study of biology, *BSCS Green* is an outstanding model for other high school texts.

Biology Honorable Mention

Heath Biology, by McLaren et. al. (DC Heath, 1991) also deserves recognition for its coverage of population ecology. The text examines the consequences of growth and the need for both developed and developing regions to lower birth rates. Population considerations are mentioned in several different locations, weaving the topic into the text.

The text expands on population growth's impact on the environment and emphasizes the important disparity in consumption patterns between developed and developing countries. A hands-on student activity uses beans to illustrate more rapid population growth due to women bearing children at an early age. In the "Issues in Bioethics" section, a case study of an African village shows how the human population can upset environmental balances for other species.

Another text deserving special attention is *Biology: Living Systems* by Oram et. al. (Merrill, 1989). This text is notable not only for its identification of rapid growth as a serious ecological problem, but also for its focus on potential solutions to the problem.

Population equilibrium (z.p.g.) is discussed, with a suggestion to teachers to emphasize zero growth rather than zero births. The text explains that a natural check on growth is an increased death rate, but that humans have the ability to voluntarily decrease their birth rate. The authors then introduce the subject of family planning, and each country's role in providing safe, effective contraceptives.

Two suggested activities include a class field trip to examine local effects of population growth on the environment and the creation of population pyramids for growing and stable populations. Finally, one section looks to the future of environmental problems. The authors suggest that solving the population problem, reducing pollution and practicing conservation are the most important steps to take.
(see next page for the biology matrix)

Biology Matrix

Publisher	Title	Year	Author	Non-human Population Dynamics	Human Population Dynamics	Population and the Environment	Population and the Future	Placement	Length
Addison Wesley	*Biology: A Systems Approach*	1988	Kormondy	A B C D E	A B C F I		A C	3/3	4
DC Heath: BSCS blue	*Biology: A Molecular Approach*	1990	Klang	E	F G H			3/3	1
DC Heath	*Heath Biology*	1991	McLaren	A B C D E	A B E F G H I	A B C D	A C E	3/3	4
Glencoe/ McGraw-Hill	*Experiences in Biology*	1985	Bauer	A B C D E	A B F H	A B C D	A B C	1/3	3
Globe	*Biology:The Key Ideas*	1986	Wong	A B	A B F H	C D	A	3/3	2
Globe	*Globe Biology*	1990	Bernstein	C E	A F H	A		3/3	2
Harcourt/Brace Jovanovich	*HBJ Biology*	1989	Goodman	A B C D E	A B E F H I	C D	A B C	3/3	4
Holt/Rinehart/ Winston	*Modern Biology*	1991	Towle	A C	A D F H		A C	3/3	3
Kendall/Hunt: BSCS green	*Biology: An Ecological Approach*	1987	Milani	A B C D E	A B C D E F G H I	A B C D	A B C D E	1/3	5
MacMillan	*MacMillan Biology*	1985	Creager	A B C D E	A B F H	A B C D	C D	3/3	2
Merrill	*Biology: An Everyday Experience*	1988	Kaskel	A B C E	B C E F	A B	B C D	3/3	3
Merrill	*Biology: Living Systems*	1989	Oram	A B C E	A B C D E F G H		A B C D E	3/3	5
Merrill	*Biology: The Dynamics of Life*	1991	Biggs	C E	A B D E F G H	A B C	A C	3/3	2
Prentice Hall	*Biology*	1987	Gottfreid	A C E	A F H		A C	3/3	3
Prentice Hall	*Biology: The Living World*	1989	Alexander	A C E	A B D F		A C	3/3	3
Prentice Hall/ Allyn & Bacon	*Biology: The Study of Life*	1987	Schrarer	E	A B D F H	A B C	A B C	3/3	4
Scott/Foresman	*Biology*	1985	Slensick	A C E	F		C	3/3	3
Scott/Foresman	*Biology: Science of Life*	1988	Wallace	A C E	A B C D E F G H I		A B C	3/3	4

Environmental Science

While most environmental science texts cover population growth thoroughly, the texts examined vary with respect to style and skill level. Educators looking for a text to use as the basis for an environmental science course should consider such features as readability and graphic enhancements in some of the books. For example, Kupchella's *Environmental Science* (Prentice Hall, 1989) has no color pictures, but the illustrations are useful and enhance the text. On the other hand, Nebel's *Environmental Science* (Prentice Hall, 1990) includes photographs and intricate diagrams, but the graphics often do not appear on the same page as the text which they describe, confusing the issue. While both books rank similarly on the matrix, they have different strengths.

Arms' *Environmental Science* (Saunders, 1990) deserves an honorable mention for very thorough discussion of human population ecology. Arms weaves information about population throughout the text and includes an extensive analysis of potential solutions to the problem of overpopulation and rapid growth. Another text deserving attention is Chiras' *Environmental Science* (Addison Wesley, 1989). This book provides comprehensive coverage of population ecology while emphasizing the disparity of consumption patterns between developing and developed regions. Finally, the two previously mentioned Prentice Hall *Environmental Science* texts (by Nebel and Kupchella) juxtapose population concerns raised by environmentalists with persuasive economic arguments for limiting growth.

Publisher	Title	Year	Author	Non-human Population Dynamics	Human Population Dynamics	Population and the Environment	Population and the Future	Placement	Length
Addison Wesley	*Environmental Science*	1989	Chiras	C D	A B C D E F G H I	A B C D	A B C D E	1/3	5
Kendall/ Hunt	*Global Science*	1991	Christensen	C E	A D E F G H I	A C D	A B C D E	1/3	4
J.M. LeBel	*Environmental Science*	1990	Person	A C E	A H	C	A	2/3	2
Prentice Hall	*Environmental Science- Living Within the System of Nature*	1989	Kupchella	A B C D E	A B C D E F G H I	A B C D	A B C D E	1/3	5
Prentice Hall	*Environmental Science- The Way the World Works*	1990	Nebel	C E	A B C D E F G H I	A B C D	A B C D E	1/3	5
Saunders	*Environmental Science*	1984	Turk & Turk	A B C D E	A B C D E H I	C	A C D E	2/3	2
Saunders	*Environmental Science*	1990	Arms	A B C D E	A B C D F G H I	A B C D	A B C D E	1/3	5

AP Biology

Many AP biology texts examined also manage to cover population topics adequately. One of the main differences in these books is their level of readability and interest. Some AP text writers add obscure vocabulary terms to simple explanations rather than explore more advanced concepts. Clearly, this is not the basis for an accessible text.

The following texts use a variety of approaches to bring population ecology to life for the reader. Postlethwait's *The Nature of Life* (McGraw/Hill, 1989) illustrates the complexities of planning for the future and emphasizes controlling growth. Interesting graphics and an attractive layout enhance readability. Campbell discusses methods of checking growth in several contexts, integrating population and ecology in Addison Wesley's admirable *Biology* (1990). Mader adopts a serious tone when examining problems of overpopulation in *Biology* (W.C. Brown, 1982) and then includes a balanced discussion of the different dilemmas facing developed and developing regions. Finally, Davis and Solomon convey the importance of human ecology in *The World of Biology* (Saunders, 1986), using persuasive language to directly argue for the need to recognize the urgency of the issue.

Publisher	Title	Year	Author	Non-human Population Dynamics	Human Population Dynamics	Population and the Environment	Population and the Future	Placement	Length
Addison Wesley	*Biology*	1990	Campbell	A B C D E	A B D E F G H I	A B C D	A B C D E	3/3	4
Glencoe/ McGraw	*Biology*	1988	Wessels	A B C D E	A B D F G H I	A B C	A C	3/3	4
Holt/Rinehart/ Winston	*Biology- 2nd edition*	1985	Villee	A B C D E	F G	A B C D	A B C	3/3	2
Holt/Rinehart/ Winston	*Biology- 3rd edition*	1987	Arms & Camp	A B C E	A B D F I	A C D	A B C D	3/3	4
McGraw/Hill	*The Nature of Life*	1989	Postlethwait	A B C D E	A B D F G H I	A B	A B C D E	3/3	4
Prentice Hall	*Biology*	1986	Barrett	A B C D E	A B D E F G H	C	A B C D E	3/3	3
Saunders	*The World of Biology*	1986	Davis & Solomon	A B C E	A B D F G H I	A B D	A B C	3/3	2
Times Mirror	*Understanding Biology*	1988	Raven & Johnson	A B C D E	A B D F G H I	A B C D	A B C D	2/3	5
WC Brown	*Biology*	1982	Mader	C E	A B C D F G H I	A B C D	A C	3/3	2
Worth	*Biology* and *Introduction to Biology*	1983	Curtis	A B C E	A B D F G I	A B C D	A	3/3	4

Conclusion

Science educators have a responsibility to introduce students to the world around them, from atoms and amoebas to entire ecosystems and galaxies. When discussing the relationship between humans and the biosphere, students must explore human numbers as well as habits. To this end, science textbooks, the most used teaching tools, should include thorough, accurate coverage of global population trends and how these trends impact the planet's life-support systems.

Given the inadequate coverage of population topics in most mainstream biology and life science texts, secondary educators must make an added effort to promote population literacy among their students. Rather than following a text through the table of contents, teachers can flip to the end of the text to cover the unit on ecology and population growth early in the course.

Texts that offer only scant coverage of human ecology can be supplemented with other population materials. To insure that texts evolve to meet the changing needs of science education, teachers and curriculum advisors should encourage textbook publishers to expand their human ecology units in further editions.

We would like to thank Dr. Wayne Moyer for his guidance and support and Bill Bennetta, Gene Kutscher, and Bill Ritz for their encouragement. We also thank the Montgomery County Public Schools and the D.C. Public Schools for access to their libraries and all of the textbook companies who sent us review copies in response to our requests. Finally, we would like to express appreciation to the Geraldine R. Dodge Foundation, Edward John Noble Foundation, David and Lucile Packard Foundation, Carolyn Foundation, and Fred H. Bixby Foundation for their generous support to ZPG's Population Education Program.

Zero Population Growth, Inc. is the nation's largest nonprofit membership organization working toward a sustainable balance of population, natural resources, and the environment in the U.S. and worldwide. ZPG's Population Education Program has provided quality population education training and teaching materials for educators since 1975. Training workshops are offered throughout the United States for teachers of grades K-12 and students of education. Teaching kits and shorter teaching units have also been developed for all grade levels.

For supplemental population teaching materials contact the groups below:

Zero Population Growth, Inc.
1400 16th Street, NW, Suite 320
Washington, D.C. 20036
(202) 332-2200

The Population Reference Bureau
1875 Connecticut Avenue, NW, Suite 520
Washington, D.C., 20009
(202) 483-1100